TOTEM mCHP with Fiat Engine: Save Money and the Environment

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Gianluca Ragonesi, Head of business development and sales, Totem Energy
With a strong expertise in the centralized energy generation the Italian Group Asja Ambiente decided years ago to move into the business of the decentralized energy generation with the strong awareness it will play an essential role in the years ahead.

Through the daughter company TOTEM ENERGY, Asja Group has become a specialist in onsite Energy Generation products and particularly in microcogeneration.

Its flagship product is the TOTEM micro CHP.
TOTEM is the evolution of the first micro-cogenerator in the world designed by FIAT Research and Development Center in 1977. TOTEM consists of the innovative internal combustion engine of FIAT 500. Manufactured by Fiat Chrysler Automobiles and designed to be fueled with natural gas and propane, coupled with a water cooled alternator for power production.

Thanks to an efficient heat exchanger system, heat is recovered from the internal combustion engine as well as the alternator and provided as a by-pass product. In addition, TOTEM is equipped with the Engine Controlled Unit developed by Magneti Marelli for a real time and precise control of the FIAT 500 engine.

FIAT Fire 1.4 CNG E6

CONTROL UNIT
«...Now a small co-generation unit, developed and marketed by Fiat in Europe and called TOTAL Energy Module, or TOTEM, is available in the U.S. Through Brooklyn Union Gas Co. In New York City...»
The first micro-cogenerator in the world: the TOTEM (15 kW)

1977

Research and Development Center of Fiat developed the TOTEM: first micro-cogenerator powered by natural gas

1987

Growing demand for energy efficiency solutions

2013

Asja Group acquired TOTEM brand and started the new TOTEM micro CHP development headed by Stefano Re Fiorentin, former Head of FIAT R&D

2016

Launch of: New TOTEM (10-20-25 kW)
### TOTEM SPECIAL FEATURES

**Modulation.** From 7.5 - 25 kW of electricity and 15 - 57 kW of heat. Electricity generated matches customer’s demand without exceeding the required need.

**Black-out start.** Working while grid failure or power outage. In black-out start mode TOTEM can be fueled either with natural gas or propane.

**Single phase ready.** Through the 3+1 wires inverter it can supply three single phase sub grid at once

**Emissions.** TOTEM emissions are up to 20 times less than a condensing boiler.

<table>
<thead>
<tr>
<th>Model</th>
<th>TOTEM 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Electrical Power</td>
<td>kW</td>
</tr>
<tr>
<td>Rated Thermal Power</td>
<td>BTU kW</td>
</tr>
<tr>
<td>Net electrical efficiency (LHV)</td>
<td>%</td>
</tr>
<tr>
<td>Total efficiency (LHV)</td>
<td>%</td>
</tr>
<tr>
<td>Inlet water temperature</td>
<td>°F / °C</td>
</tr>
<tr>
<td>Engine</td>
<td></td>
</tr>
<tr>
<td>Engine Control Unit</td>
<td></td>
</tr>
<tr>
<td>Fuel</td>
<td></td>
</tr>
<tr>
<td>Black-out start capability</td>
<td></td>
</tr>
<tr>
<td>Input power rate (LHV)</td>
<td>BTU (kW)</td>
</tr>
<tr>
<td></td>
<td>Th/hr</td>
</tr>
<tr>
<td>Input power rate (HHV)</td>
<td>BTU (kW)</td>
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<tr>
<td></td>
<td>Th/hr</td>
</tr>
<tr>
<td>Gas pressure requirement</td>
<td>W.C.</td>
</tr>
<tr>
<td>Emission settings (NOx)@ 5% O₂</td>
<td>lb/MWhr</td>
</tr>
<tr>
<td>Emission settings (CO)@ 5% O₂</td>
<td>lb/MWhr</td>
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</tbody>
</table>

* Referred to the input water temperature 95 F (35 °C)
Short payback time. 2 - 4 years on average due to bills cost savings (heat and power).

Indoor / outdoor. Suitable to indoor and outdoor installation.

Flexible operation. Designed to single and cascade operation.

Robust and reliable. The real time and precise control of the FIAT Engine through the Magneti Marelli Engine allows a predictive maintenance: components are replaced only when TOTEM efficiency start decreasing, therefore TOTEM efficiency is ensured all over time.
Production plant is located in Turin (Italy). It is over 2,100 m² area designed according to the maximum efficiency standards: all taking place within that area, from research and development of new models to the production, assembly and testing, is characterized by a rational use of energy produced and consumed.

Production capacity is currently set up to 600 units per year.
TOTEM
HOW CAN WE PRESERVE THE ENVIRONMENT?

+ 1.57°C
increase in temperature in Italy in 2014 compared to the climatological normal values 1961-1990

...nearly doubled than worldwide!

Sources: NCDC/NOAA e ISPRA
Air pollution
Italy, one of the worst records in Europe.

84,400
Deaths per year caused by air pollution.

25 times +
Compared with the victims of car accidents (3,380 deaths).

Source: AEA Agenzia Europea Ambiente ISTAT, 2014
If all the residential boilers in Italy (with exception of single houses) were replaced by TOTEM microcogenerators that would lead to:

- **30,000 deaths**

per year caused by air pollution (thanks to the yearly reduction of about 1500 Tons of Nox and 7500 Tons of Particular Matters).

Source: Althesys study on microcogeneration
TOTEM APPLICATIONS

- Wellness centers
- Accommodations
- Restaurants
- Healthcare
- Residential
- Public
- Agricultural sector
- Distribution
- Small / medium industry
<table>
<thead>
<tr>
<th>State</th>
<th>Hotels and motels</th>
<th>Grocery stores</th>
<th>Apartments complexes</th>
<th>Public Schools</th>
<th>Private Schools</th>
<th>Hospitals</th>
<th>Nursing homes</th>
<th>Retirement community</th>
<th>Total</th>
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<td>172</td>
<td>388</td>
<td>1,131</td>
<td>11,637</td>
</tr>
</tbody>
</table>

More than 100,000 opportunities.....

* Source: US database Data-list.com
BUSINESS CASE
SWIMMING POOL | PAYBACK CALCULATION
LOCATION | PIEMONTE, ITALY

Annual energy cost without TOTEM
Heat (39,247 therm/year )  78,621 €
Power (267,045 kWh/year)  49,817 €

Solution
TOTEM 20  x 1
Working hours  8,600

Annual energy and operation cost with TOTEM
Heat  54,937 €
Power + TOTEM Operations cost  53,465 €

Cumulative net savings for 10 years  144,870 €
Payback Time*  2.7 years

* With reference to energy prices applicable to Italy. TOTEM unots w/o black start feature.
BUSINESS CASE
CONDOMINIUM | PAYBACK CALCULATION
LOCATION | EMILIA ROMAGNA, ITALY

Annual energy cost without TOTEM
Heat (38,383 therm/year )  137,015 €
Power (496,904 kWh/year)  112,052 €

Solution
TOTEM 20  × 2
Working hours  4,917

Annual energy and operation cost with TOTEM
Heat  86,086 €
Power + TOTEM Operations cost  131,166 €

Cumulative net savings for 10 years  209,250 €
Payback Time*  3.4 years

* With reference to energy prices applicable to Italy. TOTEM unots w/o black start feature.
Swimming Pool Adria Nuoto

Unit type
TOTEM 25

Number of units
2

Fuel type
Natural Gas

Application type
Wellness centers

Location
Northern East | Italy
HOTEL REFERENCE CASE

Hotel Du Cheval Blanc

Unit type
TOTEM 20

Number of units
2

Fuel type
Natural Gas

Application type
Tourist accommodation

Location
Northern West | Italy
HOTEL & TERME
REFERENCE CASE

Hotel Weiss

Unit type
TOTEM 20

Number of units
1

Fuel type
Natural Gas

Application type
Tourist accommodation

Location
Angermünde | Germany
RETIREMENT HOUSE
REFERENCE CASE

**Retirement House Sant’Anna**

**Unit type**
TOTEM 20

**Number of units**
1

**Fuel type**
Natural Gas

**Application type**
Healthcare

**Location**
Eisenach | Germany
STUDENT ACCOMMODATION
REFERENCE CASE

Student accommodation

Unit type
TOTEM 10

Number of units
1

Fuel type
Natural Gas

Application type
Residential

Location
Luton, London | United Kingdom
PUBLIC REFERENCE CASE

Fire station

Unit type
TOTEM 20

Number of units
1

Fuel type
Natural Gas

Application type
Public

Location
London | United Kingdom
Still using the same old boiler? It’s time to change, choose TOTEM

TOTEM BENEFITS TO GAS UTILITIES

More revenues. Due to electric market penetration (if any existing customer would buy a TOTEM unit this would bring up to 30% more natural gas consumption).

Customer loyalty. CHP customers will remain long term natural gas users thanks to reduced energy costs and great savings.

System resilience. Offering the Black-out start feature to customers that need reliability in the face of outage.

Better image. “Greener” utility that promotes a “sustainable” product and therefore will have a better image in the marketplace.
TOTEM Energy aims to make North American market one of its major markets within the next few years.

In addition to Natural Gas Utilities, we are looking for a strong engagement with:

- Dealers and distributors
  (ex. HVAC companies, larger CHP distributors, companies that are familiar with mCHP technology).

- Energy Service Companies ESCO’s
TOTEM ENERGY WORLDWIDE

Italy
Main Distribution, Marketing and Production

United Kingdom
Distribution

Germany
Distribution

Czech Republic
Distribution

Slovakia
Distribution

Ireland
Distribution

Poland
Distribution

Belgium
Distribution

Netherlands
Distribution

Luxembourg
Distribution

Colombia
Distribution

USA & Canada
Coming soon

China
Market Development

Brazil
Market Development

Russia
Market Development

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